

REMARKS

Examiner Nadav is thanked for his thorough examination of the Subject Patent Application. Amendments have been made to the Claims and in so doing are now believed to be render the Claims distinguishable from Examiners cited prior art and therefore be in condition for allowance.

The present invention now clearly describes a metal interconnect structure, comprised of a metal structure located on one side of a via hole filled with a recessed plug, and comprised of a metal ring structure located on the recessed metal plug structure in the via hole. Of importance, and not shown in Examiners cited prior art, (Nagashima, US 5,312,773), is the fact that the metal interconnect structure is continuous and comprised of a single material. Amended Claim 20, now features the key structural detail as "a continuous upper level, metal interconnect structure." Applicants structure "works" because of the continuity of the upper level structure, connecting both components, (metal structure and metal ring). Nagashima does not show this continuity. Fig. 7, for the Nagashima prior art shows conductive component 36, attached to conductive component 50, via sidewall spacers 42 - 46. In contrast applicant describes a single material, being continuous from the top surface of the insulator layer, to the top surface of the recessed plug structure, passing continuously over the side of the via hole, without the use of conductive spacers as was used by Nagashima. In addition applicant, in amended Claim 20, describes the metal structure component of the continuous upper level interconnect metal structure, located on only one side of the via hole. Again none of Examiners cited prior art

TSMC99-646B

describe this feature. Dependent Claims 21 - 24, have also been amended to reflect the changes made to independent Claim 20.

Therefore regarding the rejection of Claims 20 - 24, based on 35 USC 103, it is strongly believed that no combination of Examiners cited prior art can be used to obtain applicants unique structure. None of the prior art describe a continuous upper level metal structure comprised of a metal structure component located on a top surface of an insulator layer, (only one side of the via hole), and metal ring structure located on a recessed metal plug structure in a via hole. The key feature of continuity allows a single deposited metal layer to be employed, in contrast to the numerous materials used by Nagashima et al, and in this case allows the metal ring structure to be formed. Therefore it is respectfully suggested that the combination of these various references still can not be combined to deliver applicants unique structure. Applicant has claimed his process in detail. The structure shown in Figs 7A and 7B, and in Claims 20- 24, are both believed to be novel and patentable over Examiners cited art references, because there is no evidence that these prior arts described a continuous metal interconnect structure, of one material, with a component of the continuous metal interconnect structure located on only one side of a via hole. We therefore request Examiner Nadav to reconsider his rejection in view of these arguments and the amendments to the Claims.

Allowance of all Claims is requested.

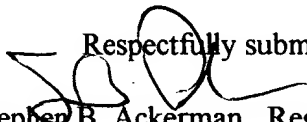
TSMC99-646B

We have reviewed the related prior art references made of record and agree with Examiner that none of these suggest the present detailed invention

Attached hereto is a marked-up version of the changes made to the Claims by the current amendment. The attached page is captioned.

"Version with markings to show changes made"

It is requested that should Examiner Nadav not find that the Claims are now Allowable that he call the undersigned attorney at 845-452-5863, to overcome any problems preventing allowance.

Respectfully submitted,  
  
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

PLEASE AMEND THE CLAIMS AS FOLLOWS:

20. (AMENDED) [An] A continuous upper level, metal interconnect structure, comprised of a

single metal element, on a semiconductor substrate, comprising:

a lower level, metal interconnect structure;

an insulator layer on said lower level, metal interconnect structure;

5 a via hole in said insulator layer exposing a portion of a top surface of said lower level, metal interconnect structure;

a recessed metal plug structure, located in a bottom portion of said via hole, with said recessed metal plug structure overlying and contacting the portion of said lower level, metal interconnect structure, exposed in said via hole; and

10 said continuous upper level, metal interconnect structure, comprised of a metal structure component[, ] and of a metal ring component, with said metal structure component [located] only on one side of via hole, located on a portion of a top surface of said insulator layer, and also located on an edge of underlying, said recessed metal plug structure, and with said metal ring component [structure, ] attached to said metal structure component[, ] and located overlying, and contacting portions of a top surface  
15 of said recessed metal plug structure, with said metal ring component comprised of metal spacers on the sides of a top portion of said via hole.

21. (AMENDED) The continuous upper level, metal interconnect structure of claim 20, wherein said lower level, metal interconnect structure is comprised of a composite metal structure, featuring an aluminum, or an aluminum based layer, at a thickness between about 2000 to 20000 Angstroms, with an underlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms, and an overlying titanium nitride layer, at a thickness between about 100 to 1500 Angstroms.
22. (AMENDED) The continuous upper level, metal interconnect structure of claim 20, wherein said via hole is comprised with a diameter between about 0.10 to 1.0 um.
23. (AMENDED) The continuous upper level, metal interconnect structure of claim 20, wherein said recessed metal plug structure, is comprised of tungsten, with the height of said recessed metal plug structure, located in said bottom portion of said via hole, between about 3000 to 20000 Angstroms.
24. (AMENDED) The continuous upper level, metal interconnect structure of claim 20, wherein said metal ring structure, attached to said metal structure component of said upper level, metal interconnect structure, is comprised of aluminum, or aluminum - copper spacers, located on the sides of said top portion of said via hole.